

SAVING FUEL, MONEY AND THE ENVIRONMENT



**MAKING TRUCK
CO₂ HISTORY**

ISSUE 1 | March 2020



A SUCCESS STORY FOR THE WORLD'S BIGGEST ONLINE - ONLY SUPERMARKET

After a 2018 review, Ocado converted to CNG powered tractor units. There were considerable anticipated benefits in terms of both the environment and cost. But they wanted more.

Ocado was determined to harness every possible opportunity to reduce fuel consumption. The next step was to look at the aerodynamics of their fleet.

They needed a wind deflector system that could work with both their 5m high double-decks and their 4.2 m high single-deck trailers.

Aerodyne's Aeromatic® solution fitted the bill perfectly. They soon upgraded to the Auto-Adjust version - allowing us to automatically switch between the 5 m and the 4.2 m trailers (or any trailer height between).

There is no need for driver input and so no danger of driver-error. The system is cross-braced, making it sturdy and robust.

After a 4-month trial, the AEROMATIC has clearly demonstrated its benefits - an additional 7.2% fuel-saving above any fuel-savings from the fixed height Airkit. This significantly reduces fuel costs and emissions. It also increases the range - a vital factor for any CNG operator (due to the current lack of filling stations).

Graham Thomas, Fleet Services Manager at Ocado said "Ocado Group tested AEROMATIC versus Fixed - Height Airkits with an excellent outcome - saving further fuel costs, increasing the CNG range of the trucks and most importantly helping us to meet our environmental goals"

**UK CONSORTIUM DEVELOP DOUBLE DECK TRAILERS
WITH IMPROVED PAYLOAD AND CO₂ SAVINGS - P2**

WHAT CAN I DO TO REDUCE CARBON EMISSIONS? - P4

AERODYNAMICS FOR CITY TRUCKS? - P6

Welcome to CO₂ magazine. The aim of this magazine is to feature recent developments in the vehicle-streamlining sector and to highlight Aerodyne's contribution to the global task of reducing CO₂ emissions.



UK CONSORTIUM WORK TOGETHER; DEVELOPING DOUBLE DECK TRAILERS WITH IMPROVED PAYLOAD AND CO₂ SAVINGS

The world's top scientists seem to be pretty much in agreement about the dangers and the causes of global warming. The world's populations are becoming increasingly strident and vociferous in expressing their concerns. Similarly, the world's leaders are coming together in agreement about the scale and urgency of the problem. Level of CO₂ continue to rise unabated, bringing increasing levels of risk to our environment and our health.

GOOD NEWS FROM THE TRANSPORT SECTOR

However, there is good news close to home - in our own transport sector. Increasingly, research is being carried out to develop design solutions that will make a serious impact on CO₂ emissions from large vehicles. In one instance, a UK Consortium has developed a new breed of lighter, more efficient double-deck trailers. These will cut CO₂ emissions and boost operating efficiency.

Funded in part by the government agency Innovate UK and partly by industry bodies, the research has two main goals -

1. To reduce the kerb weight of a standard double-deck trailer by two tonnes - optimising its carrying capacity
2. To achieve a 14% reduction in its drag coefficient - saving fuel and cutting CO₂ emissions



The Aerodyne contribution

Wind tunnel tests have already been carried out on changes to the original prototype double-decks. These include

- an Aerodyne-developed front top moulding
- an Aerodyne-developed vertical central 'blade' on the front bulkhead
- a modified version of the tapered rear end

Early results suggest a dramatic improvement in efficiency. Pressure measurements were taken at the front and rear of the trailer, with data suggesting the new top moulding and vertical blade offer a combined 6% reduction in the trailer's drag coefficient. Meanwhile, the tapered tail adds a further 3.4% - a combined reduction of 9.4% CD.

Saving on fuel - helping the world

The consequences for fuel-saving with these developments are considerable. Early signs are that a significant 11.2% less diesel per tonne-km of transport work will be used than the standard trailer (9.1% due to increased payload; 2.1% from aerodynamics)

Andy Richardson, of Lawrence David is excited by the research and the resulting developments. He sees the project as having implications far beyond its current goals, specifically in terms of reducing greenhouse gases.

“It's helping the industry, it's helping us and it's helping the world.”



“ IT'S HELPING THE INDUSTRY, IT'S HELPING US AND IT'S HELPING THE WORLD ”



Tesco's participation in the double-deck trailer project will play a part in Tesco's long-term ambition to be a zero-carbon business by 2050. Its road transport operations will play a significant role in achieving this target. The company has committed to reducing CO₂ emissions per-case-of-goods-delivered by 25% compared to their 2011/12 baseline.

Aerodyne is delighted to be playing its part in this research. We look forward eagerly to supporting and contributing further to this vital project.

Companies Involved:

- Tesco PLC
- University of Cambridge
- Lawrence David Ltd.
- Aerodyne Global Ltd.

WHAT CAN I DO TO REDUCE CARBON EMISSIONS?

Since the 1950's, the Diesel engine has been the only real choice for commercial vehicle operators. With all the alternatives, life is more difficult and usually you will find that one size no longer fits all.

BEFORE WE LOOK AT ALTERNATIVES, IT IS IMPORTANT TO REMEMBER THE BASICS OF GOOD FLEET OPERATION:

- Driver training and monitoring with telematics
- Vehicle in optimum condition particularly tyre pressures
- Aerodynamic aids on Cab, Bodywork and Trailer all optimised and correctly adjusted.

Getting these right can have significant effects on CO₂ at minimal cost.

GTL and HVO (bio diesels)

The simplest alternative to reduce CO₂ is to use a biofuel where the carbon emitted from the exhaust is balanced by the carbon absorbed in the growing phase of the organic material.

The first-generation FAME bio diesels are not stable enough at anything except low blends with Euro VI engines. Gas to Liquid (GTL) and Hydrogenated Vegetable Oil (HVO) are second generation bio diesels, these are usable as “drop in” fuels.

This means that the engine will work well with no changes to maintenance regimes etc even at 100%. Availability in the UK is limited, and costs are an issue at present but fleets who have trialled them report good results.

The challenge that any biodiesel will have is public perception. With the current demonization of diesel, this could prove to be a losing battle.

Electric

Electric vehicles are not a new concept in fact some of the earliest vehicles were electric. The game changer has been the development of new battery technologies such as Lithium Ion which have improved energy densities and are capable of being recharged in relatively short times.

In the passenger car world, Electrics have moved from small quirky vehicles to mainstream from most OEMs.



For commercial vehicles it is still very early days, there are a few “car derived” LCVs on the market and, in the large van segment, products are available from LDV, Iveco, Renault and soon Mercedes, Volkswagen/MAN and Ford. New starters such as London Electric Vehicle Company and Arrival have products coming to market soon. The Fuso E Canter is also available in light to medium 7.5t sector.

The Batteries are still the limitation for all these products. If you want to achieve a decent range, you need more batteries which have adverse effects on payload and more importantly cost. The range available will almost certainly mean that these vehicles will be destined to urban operations.

Purchase costs are high but partly helped by the “plugged-in van grant” - up to £8000 for vehicles up to 3.5t and up to £20,000 above 3.5t. Other than in the London congestion charge zone it is difficult to make the economics stack up.

Moving up the weight range, all OEMs are developing products generally for the rigid market as the range and payload will rule out most artic work.

For Artics, in particular 6x2's so loved by the UK, the space available for batteries renders pure electrics only suitable for very low range niche applications.



Range extended Electric

Tevva have successfully converted several vehicles for UPS (mainly Euro V Mercedes Vario models) to range extended electrics. The technology lends itself to a zero emission capable vehicle.

Natural Gas CNG and LNG

Gas fuelled spark ignition engines have been around since the birth of the internal combustion engine. Indeed, Nicholas Otto used town gas as the fuel for his early developments.

In Euro VI, spark ignition offerings are available from Scania and Iveco. Power ratings are now 400 – 460hp. Volvo and Mercedes have rigids at circa 300hp available as well. Volvo has also recently returned to the market with a 460hp engine featuring HPDI (high pressure direct injection) technology. This is still a compression ignition cycle but using only a small amount of diesel as a liquid spark plug.

Whilst the spark ignition engines are available with either Compressed Natural Gas (CNG) or Liquid Natural Gas (LNG), the Volvo HPDI is only available for LNG. The choice of LNG or CNG will depend on the vehicle operation.

LNG has an energy density that is circa 2.5 times that of CNG. This means that in a limited space available for tanks, the LNG vehicle will have a range 2.5 times better than the CNG vehicle. LNG is a cryogenic liquid and needs drivers to have the necessary training and Personal Protection Equipment. At circa - 160deg C, it must be treated with respect.

Filling a CNG vehicle is simpler with no PPE required. As the fuel is identical in composition, the emissions will be the same with either fuel. The difference being only the storage system. With

6x2s now available from Volvo and Iveco and the economics looking good for long distance, now seems to be the time for gas vehicles to take a significant slice of the market.

Natural gas (methane) can also be produced as bio methane from land fill or more typically now from Anerobic digestion. Bio methane is useful as it can reduce the CO₂ emissions from vehicles (on a well to wheel basis) by 80% and more.

Natural gas vehicles are a “here and now” technology that may well be replaced in the long term with other zero emission technologies but for now are the only real game in town for long distance operations.

Hydrogen

On the face of it, Hydrogen sounds like the ideal alternative. It can be used in a fuel cell and the emissions from the vehicle are water.

Hydrogen has a low energy density meaning that space is required for tanks. On Artic vehicles this will be an issue. There are currently a few buses running in the UK on hydrogen. These are short distance, back to base operations using long wheelbase single deck vehicles with plenty of space for fuel tanks on the roof. Range is not an issue in this operation. Costs are at present very high.

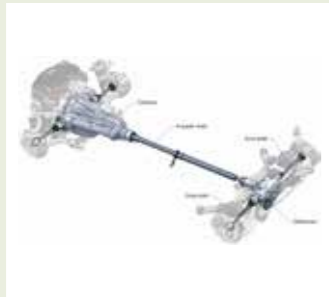
Hydrogen has been the fuel of the future for many years and it seems still many years away from mass production. The most likely use of Hydrogen could be as a zero-emission range extender for an electric vehicle if the costs and weight of the fuel cell and hydrogen tanks can be competitive against an additional battery.

AERODYNAMICS FOR CITY TRUCKS?

We lose count of the number of times we've heard this comment - the view that there's no point in fitting aerodynamics to trucks which operate only in urban areas. After all, the forces of drag that build up below 30 mph are negligible ... aren't they?

TIME TO THINK AGAIN!

The science of aerodynamic drag demonstrates with crystal clarity that this assumption is simply false. Where better to look than the evidence? When a truck moves, the engine has to combat three main forces -



Drive train friction

The loss of power in the drive train, an area in which all OEMs are striving to improve efficiencies. Let's leave them to it.



Tyre rolling resistance

This relates to vehicle weight, the heavier the vehicle, the more the power needed to move it.

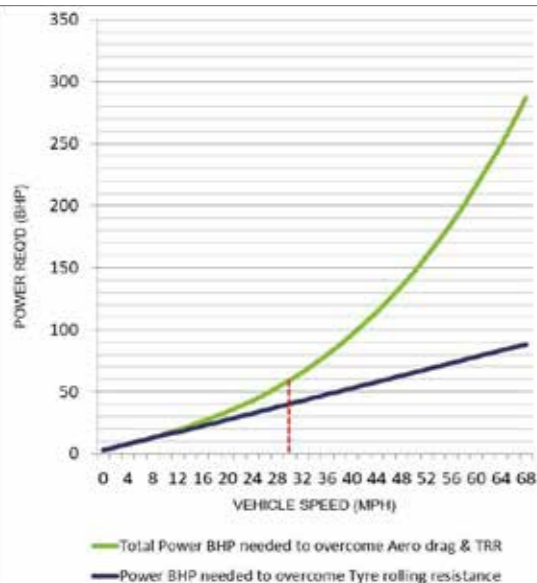


Aerodynamic drag

This relates to the shape of the vehicle. Think Formula One car versus double-decker bus! It's easy to test, as a car passenger, (taking care with potential obstacles!), put your arm horizontally out of the window. Bend your arm at the elbow, palm points up. In the vertical plane, your hand is pushed back - but in a horizontal plane, the forces are much less!



Now let's turn our attention to two weights of vehicle and the amount of drag they generate at a variety of speeds...



18-TON RIGID VEHICLE SCENARIO

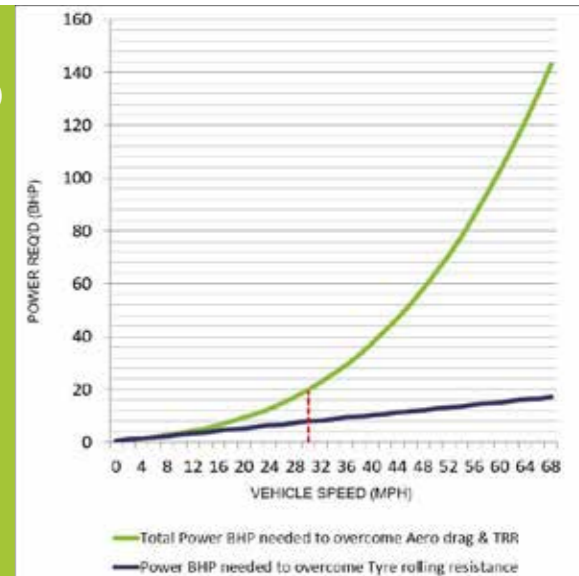
As the vehicle doubles its speed, it needs 2x power to overcome its weight and 8x power to overcome aero drag.

The vertical axis shows the engine power required (in BHP). The horizontal axis shows the vehicle speed. In this first example below, aerodynamic drag starts to use engine power at around 10MPH. At 30mph, 56% (35 BHP) is being used

3.5-TON RIGID VEHICLE SCENARIO

Now, look at this second graph - the same scenario but for a 3.5-ton vehicle. At 30mph, only 36% (8 BHP) is being used to overcome weight ... but 64% (14 BHP) of the engine power is overcoming aero drag.

Check out the dramatic increase between 12 and 30mph.



LOW-SPEED AERODYNAMICS DO COUNT

% of Power (at rear wheels) used to overcome aerodynamic drag

Weight	30mph	45mph	60mph
3.5 tons	57%	74%	84%
10 tons	40%	59%	73%
18 tons	28%	46%	61%

This evidence leaves no room for doubt. The lighter the vehicle, the lower the speed required to see a benefit from aerodynamic improvements.

Every company operating 3.5-ton trucks in urban areas should ensure their aerodynamics are up to scratch. This is the perfect win-win. A win for the bottom line and a win for the environment!

Steve White, Head of National Fleet for Reynolds Catering says: "We were amazed at Aerodyne's Airkitt producing over 20% fuel-saving - they've opened further fuel-saving opportunities for Reynolds, helping us to meet our environmental goals"



SUSTAINABILITY IN THE CITY

Daimler Trucks exhibited at Freight in the City in November, focussing on safety and air quality by exhibiting three trucks from its FUSO and Mercedes-Benz brands.

WHEN IT COMES TO SUSTAINABILITY, DAIMLER TRUCKS HAS MADE A COMMITMENT TO THE GOALS OF THE PARIS CLIMATE AGREEMENT AND DECARBONISING THE INDUSTRY.



With the manufacturer holding the title of the world's largest truck maker, this is a bold step, and Daimler Trucks plans to offer only new vehicles that are CO₂-neutral by 2039. In addition, all of its European truck plants will be CO₂-neutral by 2022, receiving their electrical energy solely from renewable sources.

As truly CO₂-neutral transport only works with battery-electric and hydrogen-based drivetrains, the company has already put 100 fully-electric trucks out with customers around the world.

The first model on UK roads is the FUSO eCanter, currently in operation with DPD, Hovis, Wincanton and Yodel.

These 7.5-tonne trucks – which have a range of 100km and a body and payload allowance of 4,290kg - have collectively travelled the equivalent of three times around the world.

Under the Mercedes-Benz brand, several variants of the eActros 18- and 26-tonne truck are in customer operation in Europe. Based on their experience with the eActros, Mercedes-Benz will develop its low-entry truck, the Eonic, into an electrified version - eEonic.

The Eonic has also been available with a low-emission natural gas engine since 2002.



At Freight in the City, a diesel Eonic tractor unit was on display. This truck - like all powered by Euro VI Mercedes-Benz Truck engines – can run on biodiesel, coal-to-liquid, gas-to-liquid or biomass-to-liquid without any engine modifications.

Yet it is the truck's safety credentials that created a buzz in London, due to the Mayor's recently-launched Direct Vision Standard.

The Eonic is one of the only trucks to score the maximum five-star rating, with its deep, panoramic windscreen, full-height glazed passenger door and seating position that allows drivers to make eye contact with cyclists and pedestrians.

Completing the Daimler Trucks' stand was the all-new Mercedes-Benz Actros, recently crowned International Truck of the Year 2020.



With cutting-edge technology such as MirrorCam, Active Brake Assist 5 and enhanced Predictive Powertrain Control, this remarkable vehicle offers major advances in terms of safety and operational efficiency.

MirrorCam turned many heads at the exhibition as it replaces conventional wing mirrors with sleek digital cameras, improving visibility while reducing aerodynamic drag.

These innovations enable the all-new Actros to offer fuel benefits of up to 5% compared with its predecessor.

For more than a century, Daimler Trucks has set standards in terms of safety, fuel efficiency and driver comfort.

With its current vehicle portfolio, and sustainable corporate strategy, the manufacturer continues to do so whilst driving towards a safe, emission-free and connected future.





AN INDEPENDENT VEHICLE ENGINEERING CONSULTANCY BRINGS NEW INNOVATIONS TO THE TRANSPORT SECTOR

Clairvaux Ltd custom-design Commercial Vehicles that produce remarkable results in the field of Air Quality Improvement.

THEIR OTHER SERVICES INCLUDE -

- Concept and detail design
- Vehicle selection and optimization guidance
- Post-Design Engineering to help you analyse in-service issues
- Best Practice Design Reviews to make sure you are getting what you really need
- Independent Design Audits to assess the durability and reliability of a design.



the propulsion is transferred to the tractor unit through the fifth wheel - avoiding any chance of torque steer or jack-knife effect.

With a 50-mile urban EV range, ZERAUD allows the tractor unit to be used in ICE mode for trunking operations and ZE mode in town.

UK Research and Innovation Support

Clairvaux Ltd are enormously grateful for the support they receive from UK Research and Innovation. UKRI provides valuable grant funding for two important Air Quality Improvement projects in the Heavy Commercial Vehicle sector.

The benefits of this funding will be twofold -

- To help in the creation of new jobs in North West England
- To maintain the UK's position as a leader in hybrid and electric vehicle technologies

ZERAUD - a revolutionary trailer electrification solution

Zero Emissions-capable, Ready for Autonomous Urban Deliveries (ZERAUD - pronounced Zero) is an Innovate UK IDP 15 funded feasibility study.

Clairvaux Ltd are designing a trailer electrification solution - a 4x2 tractor unit performs like a 6x2 tractor unit when coupled to the trailer.

Zero torque steer or jack-knifing

The electric drive comes from the trailer. So, what you have, in effect, is a diesel-electric hybrid. Using a patent-pending design,

Harvesting regenerative braking energy

On the same theme, Regen for All aims to harvest regenerative braking energy from as many semi-trailers as possible. The energy will be used in V-2-G and even V-2-V applications.

Refrigerated trailers will be able to power the Transport Refrigeration Unit (TRU) from a battery pack charged entirely by regenerative braking - no plug-in hybrid approach.

Dry freight trailers will store a significant amount of energy, either transferrable to the grid or into a stationary storage facility. A third alternative is to have an EV plug-in directly for Rapid Charging.

This provides Vehicle-to-Vehicle (V-2-V) power transfer within a mixed fleet environment. The result? Reduced reliance on expensive infrastructure adaptations on leasehold properties.



TEVVA LAUNCHES PROGRAMME TO DEPLOY ELECTRIC TRUCKS ACROSS UK AND EUROPE

Electric commercial vehicle technology pioneer, Tevva, has launched a new initiative to enable logistics fleets to start electrification of medium-duty HGVs in spring 2020.



Unveiled at the Freight in the City Expo at Alexandra Palace, the Tevva Electrify initiative comprises a unique package of EV technologies - including bespoke battery packs and management systems and cloud-based software that controls a range extender - on its in-service, medium-duty trucks.

The seven companies who have committed early to the first Tevva Electrify cohort will be taking delivery of a total of eight eTrucks packed with Tevva's ready-made EV solutions.

The Commercial EV Technology Fleet demonstrates in a real-world environment the safety, reliability and durability credentials of Tevva's technology. The initiative also aims to drive confidence in EV technology among logistics firms looking to lower fleet ownership cost, comply with emissions regulations, address their carbon footprint and impact on air quality and climate change.

David Thackray, Tevva Sales and Marketing Director, says:

"When Tevva was founded in 2013, businesses were asking whether electric trucks could displace diesel. The question today is 'when'. The answer is, 'sooner than most people think.' The big players in the transport industry already see the benefits but too many businesses still aren't really aware. Tevva Electrify will enable a better understanding and increased adoption of the essential new technology. This is vital for the planet - the climate emergency is shockingly real - it won't wait for industry to catch up."

The 50-strong Tevva electrify demo fleet, available later in 2020, will be deployed across over 200 fleets in at least five countries.

It will amass an estimated 4 million km, proving that businesses will save up to 20% on TCO, whilst remaining environmentally effective.

The Tevva initiative offers a three or six-month trial period, during which they will provide detailed telematics data to clearly show the all-round all operational benefits. Tevva will also provide all necessary training for technicians and drivers.

Businesses can choose to keep the vehicle at the end of the trial and enjoy priority for further vehicles they order.

Furthermore, Tevva ensures that their next-generation electric motors use no rare earth materials. Furthermore, end-of-life batteries are repurposed in a fully sustainable way.

For back-to-base delivery applications, the operator benefits from lower total cost of ownership, zero or near-zero emissions, low noise levels, no range anxiety and a superior driver experience.

For more information, visit www.tevva.com or email electrify@tevva.com.



LEADERS IN FUEL-SAVING TRUCK
AERODYNAMICS SINCE 1979

Dedicated to reducing fleet carbon emissions.



To find out how we can help your fleet,
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